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British Journal of Anæsthesia

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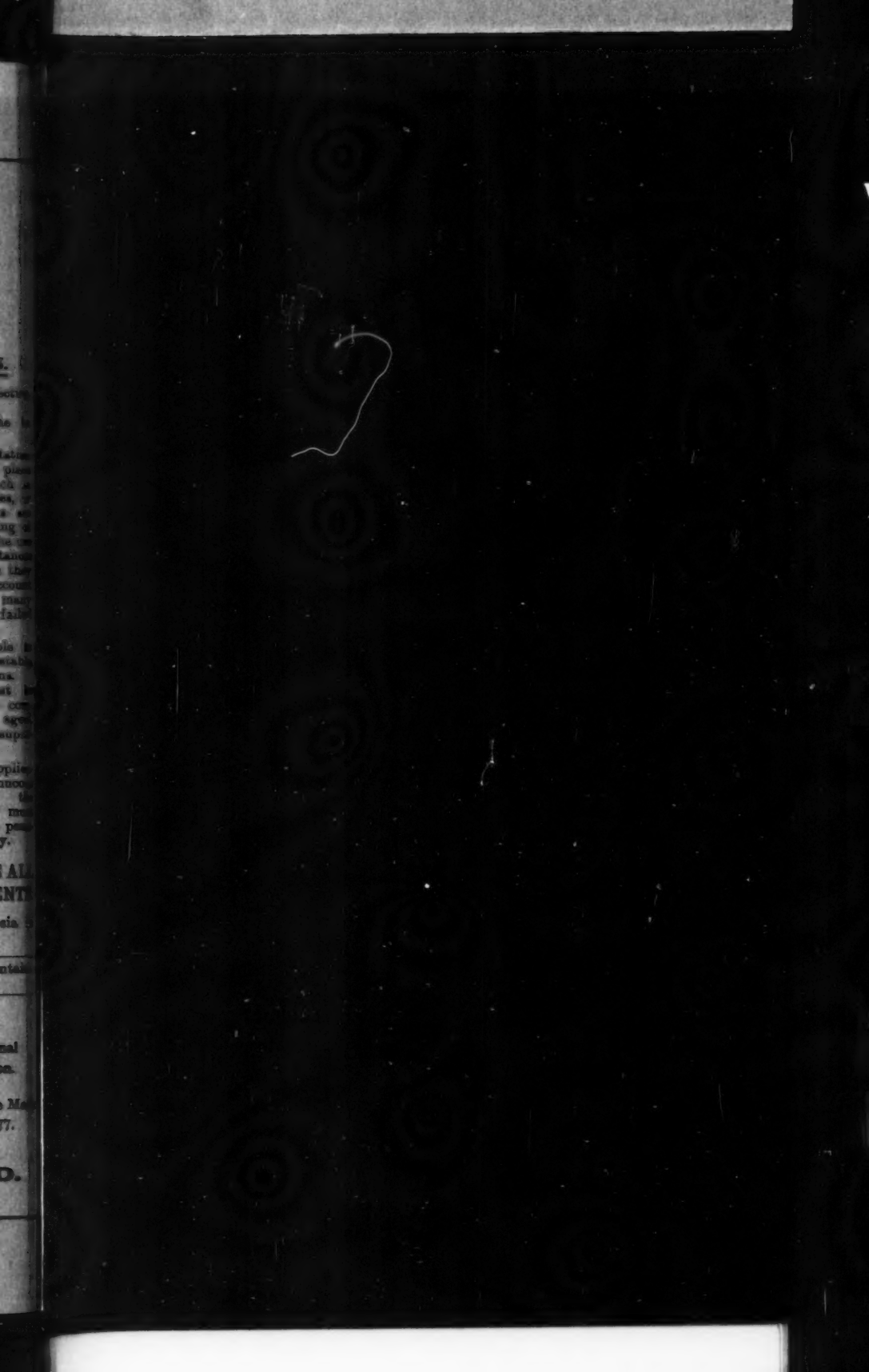


British Journal of Anæsthesia

VOL. I. NO. 2. OCTOBER, 1923.

JOSEPH THOMAS CLOVER, 1825—1882: A PIONEER IN ANÆSTHESIA.

By DUDLEY WILMOT BUXTON, M.D., B.S., M.R.C.P.,

Consulting Anæsthetist to University College Hospital, the National Hospital for Paralysis and Epilepsy, and Physician Anæsthetist to the West Herts Hospital, Hemel Hempstead.

IN the original edition of the "Dictionary of National Biography" no room was found for this man, who of all others placed upon a scientific basis the methods of employing ether. Curiously enough, however, we read in this dictionary of another Joseph Clover (1725—1811) who also came from Norfolk. This man was a farrier, the son of a blacksmith, and he did a certain amount of useful work on the diseases peculiar to horses. Such is fame!

The average person, if asked who was Clover, would reply, "The man who made the inhaler." However, Clover did far more than this, for, as I hope to show, it is to him that we owe the inception of our present knowledge of ether administration. That this man, together with his work, is not better known, is probably due to the fact that he wrote little and sought the limelight of professional gatherings not at all.

I was privileged, through the kindness of Mrs. Clover, his widow, and Mr. Martin Clover, his son, to look through the memoranda and sketches which Clover left behind him. Although these showed the ingenuity and meticulous care with which he worked at the problems of ether administration, yet unfortunately they were unsuited for publication. They revealed the atmosphere in which he laboured, but failed to afford the detail requisite for a memoir such as I at that time hoped to produce.

The story of Joseph Clover's useful life is soon told. Born in 1825 at Aylsham, in Norfolk, he received his education in the Grey Friars' School at Norwich, and in due course was entered as a pupil at the Norfolk and Norwich Hospital, a place ranking high among the provincial hospitals, known to many as the hospital in which Sir Peter Eade and Mr. William Cadge, the lithotomist, did such valuable clinical work. In my early days I held a post there, and, looking back, I appreciate what valuable lessons were to be learnt by a pupil attached to it.

In 1844 Clover passed to University College Hospital, and in due course became house surgeon to Mr. Morton and to Mr. Syme, then a surgeon attached to that school. When Syme migrated to Edinburgh he offered to Clover the post of his assistant, but the latter preferred to remain in London, and undertook the responsible duties of Resident Medical Officer to the University College Hospital, a post which he held for five years. It will be seen from these dates that he was a fellow student with Lord Lister, and saw the surgical work of Syme and Liston, and was present on the historic occasion when the last-named surgeon operated upon a patient who had been rendered anæsthetic by the inhalation of ether; this was the first major operation performed in London, the patient being anæsthetized. This took place in the old operation theatre of University College Hospital on December 21, 1846.

As Resident Medical Officer it was Clover's duty to give anæsthetics to patients, and thus his attention was early focussed upon this branch of his profession. In 1853 he became a Fellow of the Royal College of Surgeons, and decided to practice as a surgeon, for which art he evinced special aptitude.

All his life Clover had been very delicate; repeatedly he had been obliged to rest from his studies for long periods, and when practice began to come to him, as it did from the commencement of his surgical career, he was regretfully forced to recognize that the arduous life of a surgeon was not for him. Perhaps his personal loss was his profession's gain, since in his day surgeons were plentiful, anæsthetists, as such, were unknown, save and except that father of the craft—Dr.

Snow. Clover decided to adopt the career of an anæsthetist, and at once began to consider the problems connected with this line of work and to improve the crude methods then in vogue.

The introduction of ether as an anæsthetic in 1846 was followed in the succeeding year by Simpson's dramatic announcement of the satisfactory employment "of a new anæsthetic as a substitute for sulphuric ether," and for the nonce the last-named agent fell out of favour. The following years revealed the dangers incident to the use of chloroform by unscientific methods, and in spite of Dr. Snow's clear teaching that such dangers were rather those of method than inherent in the drug itself, popular and professional opinion became unsettled and distrustful as to what drug, if any, should be used for the production of anæsthesia. The Royal Medical and Chirurgical Society of London, now the Royal Society of Medicine, appointed a committee to investigate the rival claims of chloroform and ether. Leading physicians, surgeons and one dental surgeon served upon the Committee, and Mr. Clover was associated with it as an expert, and superintended the large number of valuable experiments which were carried out under its auspices. The Report was published in 1864 and marks the commencement of Clover's serious work upon the best methods of anæsthetization. After rehearsing the data upon which its conclusions were based the Report summarized its findings somewhat as follows: Chloroform, the Committee contended, was more dangerous than ether, its danger being due to excessive or irregular dosage. "It is," indicates the Report, "as desirable to measure accurately the strength of the vapour (of chloroform) as to weigh the dose of a medicinal agent administered by the mouth." It continues: "The only apparatus at present known to the Committee which fulfils the necessary conditions is that contrived by Mr. Clover. . . . ." This statement fails to do justice to Dr. Snow, whose apparatus was a definite attempt to supply a truly dosimetric inhaler, which enabled the administration of known strengths of chloroform vapour. However, Clover's bag and mixer were certainly more accurate, as by their use the vapour offered to the patient was always of a definite strength and so uninfluenced by the rate of

respiration and amplitude of the pulmonary ventilation. The Committee, while admitting the greater safety of ether, considered that it was an undesirable anæsthetic as its employment took too long and its effects were too uncertain and unreliable.

This conclusion was inevitable as the methods of etherization were wholly unsound. The apparatus used was of two types. In one a flask containing pieces of sponge was connected with a tubulure ending in a cap which either covered the nose and mouth or merely the mouth, air being admitted into the flask or the face-piece; in the other a large mask, such as has come down to us as Rendle's mask, into the summit of which ether was poured from time to time and was soaked up by a pad of cotton wool. Various forms, from a rolled towel to Morgan's hat-like inhaler, were adopted, but all lacked precision, and their use often caused furious excitement but poor anæsthesia.

Thus the two problems for solution which confronted Clover were (1) how to speed up the induction of anæsthesia when ether was used, and (2) how to regulate the strength of the vapour according to the requirements of the patient and the necessities of the operation in progress. Clover recognized that the gravamen was not to prove which anæsthetic was dangerous, but was in fact how to standardize methods. It is curious how frequently the all-important question of method has been neglected. One finds this throughout the history of anæsthesia; it crops up in the various commissions and reports of committees, and recently in a discussion on the relative safety of chloroform and ether which appeared in our journals but few of the disputants dealt with method while they advocated one or other of the dominant anæsthetics. Clover's ingenuity and knowledge of physics found the task he set himself at once stimulating and congenial.

In 1862 he introduced his regulating chloroform inhaler, to which a reference has been made, but he never liked the anæsthetic nor adopted the mixtures, A.C.E., the two mixtures C_2E_4 and C_2E_3 invented by Dr. George Harley, and described before the Royal Society. Nitrous oxide gas introduced into this country in 1866 as an anæsthetic, offered Clover what he wanted, and led him to advocate and perfect

the method of inducing anæsthesia by a sequence of this gas and ether. The apparatus was invented and described in 1876. By it an induction period of from one-and-a-half to two minutes was provided for, and a continuous inhalation was achieved, first nitrous oxide then this gas mixed with ether vapour in advancing strength, and finally ether vapour with air.

The introduction by Dr. Ormsby, of Dublin, of his ether inhaler provided an apparatus half-way between the older and crude inhalers and Clover's closed method. This inhaler, however, appealed to some surgeons, and when Clover published his gas and ether method an alternative plan was launched upon the profession. This was the use of gas from an ordinary gas-bag followed when unconsciousness was assured, by ether given in full strength from the Ormsby inhaler. This method lacked the precision of Clover's plan, and failed to provide a continuous gradually increasing strength of ether vapour, such as Clover shrewdly recognized was the ideal to which the anæsthetist should direct his efforts.

The apparatus which Clover devised, as is well known, consists of a metal receiver for the ether surrounded by a water-jacket. This jacket in subsequent models was made smaller, and the thermometer at first inserted was omitted. From the receiver a tubulure traverses a rubber bag, the latter being similar, although smaller, than the gas-bag then in use. Into the bag nitrous oxide could be made to enter. At the distal end the regulating mechanism made of metal received the far end of the tubulure and the opening into the gas-bag. By this, entry of gas and ether in requisite proportions was effected, and it also gave attachment to the rubber face-piece. Clover devoted much time and experiment to the construction of the tubulure and face-piece. He found that, provided the lumen of the passage from the face-piece to the ether supply was at least as large as the lumen of the trachea, no difficulty or discomfort in breathing could or did take place. Indeed, when it was made larger the "dead space" was increased and aerial stasis was favoured. He elaborated the face-piece with great care, taking moulds of various faces, and by the use of air cushions the mask was made to fit accurately. This was a great advance upon the mouth or oro-nasal cap previously employed, as breathing into the mask is easier

and less laborious than the aspiration from the mouth cap through a long tube. The actual area of respiration in this apparatus is that provided by the mask, so that no question of dyspnœa arises provided the mask is of the appropriate size. These details have been dwelt upon because they afford a glimpse of the grasp Clover had of the necessities of the technique he was elaborating and of the ingenuity he brought to bear upon his task.

As nitrous oxide was not within access of many practitioners, Clover set to work upon an ether inhaler which would be used for ether alone. This was his "portable regulating ether inhaler," the best known of his apparatus, and one which has been variously modified, but not in every case improved by succeeding generations of anæsthetists.

But Clover was not only a mechanic, draughtsman and inventor, he possessed a sound knowledge of the theory of the uses of anæsthetics which are revealed in his writings. Unfortunately, his published papers are few. One point may be cited in support of this statement. As soon as Clover's apparatus came into general use a certain school of ether enthusiasts, the most prominent of whom was the late Mr. Pridgin Teale, of Leeds, taught that air exclusion was an essential in inducing anæsthesia by ether, and that cyanosis, so far from being harmful, was an essential part of the technique. To this Clover refused to subscribe, and taught that cyanosis must be avoided by lifting the inhaler off the face every sixth or eighth respiration so that one complete expiration followed by one complete inspiration of pure air could be obtained. The fact that carbon dioxide is a mild anæsthetic is not overlooked in the above statement. It is not the inhalation of the gas which is responsible for the obnoxious cyanosis, it is the undesirable delimitation of oxygen which makes for danger and increases the unpleasant after effects, while it gives rise to the miserable feeling of asphyxiation, such as obtained in the old days. Some years ago the present writer examined a large number of cases, and found that whenever cyanosis was allowed to develop a minor complication always arose, while the recovery from anæsthesia was invariably associated with headache, nausea or vomiting, conditions seldom evinced by patients who were not overdosed

or deprived of sufficient oxygen. The apparatus which Clover produced are the prototypes of succeeding ones, and his teaching is the basis of much, if not all, that we now adopt in our lectures, although the source of inspiration is at times overlooked.

It is true that our armamentarium is increased, for we have the additions enabling us to use endo-tracheal, intravenous, colonic, warmed ether vapour and other methods. Clover designed, but seldom employed, nasal tubes through which patients could inhale. Ellis' method of the use of mixed vapours and the semi-open ether methods which were soon evolved did not come within Clover's purview and so call for no detailed notice. Ethyl chloride, although introduced as an anæsthetic in 1848 by Heyfelder, does not appear to have interested Clover, although he adopted the use of ethylene dichloride and employed it in nearly two thousand cases. He refers, but guardedly, to ethyl bromide, and he did not personally adopt its use.

Clover, who was unofficially attached to University College Hospital, delivered lectures there at wide intervals. These gave no systematic teaching, but were made the avenue by which he introduced fresh methods or detailed the use of newly-adopted anæsthetics. His writings, scattered through medical journals were few, and chiefly in the form of letters to the editor. He, with the late Mr. G. H. Bailey, contributed the article on Anæsthetics to Quain's "Dictionary of Medicine."

As has been mentioned, Clover was first a surgeon and afterwards an anæsthetist. Surgery owes to his genius useful surgical apparatus, notably Clover's bottle for exhausting débris after lithotomy, in which he adopted Sir F. Crampton's suction method, and Clover's crutch, so valuable when the patient is placed in the lithotomy position.

It was said of Clover, "His end was quite in keeping with his whole life—gentle, amiable, uncomplaining to the last. The world wants one true man since he was taken away."

So Clover passed in 1882; he built for us, his pupils, a great structure, he worked as we should work, for the good of mankind, for the assuaging of suffering and the advance of true science. Let us do him honour and emulate his efforts.

PAINLESS CHILDBIRTH BY SYNERGISTIC METHODS.

[Second Paper.]

By JOHN O'REAGAN, M.D., LELAND R. COWAN, M.D.,
House Surgeons, Fifth and Sixth Floors, Lying-in Hospital;
and
JAMES T. GWATHMEY, M.D.,
New York City.

IN our preliminary paper[1] we outlined the conditions by which it is proposed to secure painless labour. One of these conditions is to modify or stop the procedure whenever mother or child appeared to be in danger. The colonic administration of some of the drugs is selected, as the parturient woman is usually prepared for this method. We cited 64 cases, but in that series one case of morphin-apnœa (not fatal) was noted, so now morphin is not given routinely, but only in selected cases and by hypodermic, and then only in the early stages. At present reliance is placed upon the synergism of ether and magnesium sulphate for the major effect, although other drugs are used. The magnesium sulphate is given by hypodermic in a 50 per cent. solution,[2] and morphin is added when indicated. The magnesium sulphate is repeated when necessary and usually without morphin. Cowan states that "In all cases the cervix has dilated with or without the addition of morphin, but dilatation has progressed faster with the thick tough cervix when morphin has been given with the magnesium sulphate. In excitable patients, and where you expect a long labour, or in cases just cited above, dissolve $\frac{1}{4}$ grain of morphin in the first hypodermic of magnesium sulphate. The ether, dissolved in one-third the amount of olive oil, is given by rectum but not to the extent as used by Thaler and Hubel.[3] The ether is not repeated, as it is retained in over 98 per cent. of the cases.

1. *British Journal of Anæsthesia*, Vol i, July 1, 1923.
2. *Amer. Journ. Med. Sciences*, March 1923, p. 431.
3. *Zentralblatt für Gynäcologie*, Leipsic 47, 337—384, March 3, 1923.

The following is the usual procedure:—Hypodermic magnesium sulphate (chemically pure) 2 cc. of a 50 per cent. solution (with or without morphin) is given when the cervix is dilated about two fingers, and repeated when necessary—one to three times. One to two hours later, a rectal instillation of—

Quin. H Br.	10 Grains
Alcohol	1 Dram
Ether	3 Ounces
Olive oil	1 Ounce

The instillation is given when the cervix is dilated two and a half to three and a half fingers, depending on the frequency of pains and severity.

This present technique is far superior to anything we have heretofore used, and with the last 40 patients has been changed only in minor details.

Normal cases—not too far advanced—are selected as otherwise the issue would be obscured. The usual method is as follows: Place patient in Sims position and insert small catheter filled with olive oil (to exclude air) three or four inches in rectum. A small glass funnel is attached to free end of catheter and is held just above the hips—the mixture is now poured in slowly. Pressure is made during pains with a crumpled towel held in the hand pressed firmly against the perineum to prevent expulsion.

Cowan improvised a technique for parturient women for which he cannot be given too much credit, and which is vastly superior to the funnel gravity method just described inasmuch as it takes less times, is less likely to be expelled, and by forcing the mixture into the upper portion of the rectum it is more quickly absorbed. It converts an uncertain procedure into a certainty and is as follows:—

Cowan's technique:—Connect catheter with large syringe holding the mixture, instil slowly and with gentle pressure force the fluid between pains, the whole amount to be instilled between two and three pains. During pains pressure upon the perineum as heretofore.

This procedure should not take over five minutes, but pressure on perineum should continue for fifteen minutes

more. The advantages of this technique are obvious. The descending head tends to occlude the rectum and make instillation by gravity long and difficult, but with a syringe we can force a considerable part of the fluid beyond the head into the upper portion of the rectum. With this method the whole amount of fluid is retained in over 95 per cent. of the cases. Relief of pain is noticed in from 15 to 45 minutes, the pain-free period lasting from four to five hours.

Results. The effect of the synergists upon the nervous system is exciting in 3 per cent. of the cases, unchanged in 3 per cent., and sedative in 94 per cent.

It was thought this excitement was due to the alcohol, which is now reduced from four to one dram. There has not been a sufficient number of cases since to determine the effect of this reduction.

The deliveries are 4 per cent. with forceps, and 96 per cent. normal.

Occipito-posterior positions rotate in about the same proportion with as without the synergists.

Comparatively, post partum hæmorrhage is unchanged.

Labour is increased in time in 4 per cent, and progresses uneventfully in 96 per cent. of the cases.

Nausea occurs in 2 per cent., thirst in 4 per cent., vomiting 8 per cent., and normal and uneventful in 86 per cent. of the cases.

Pain is increased in 1 per cent, unchanged in 3 per cent., and modified or painless in 96 per cent. of all cases.

Condition of Baby. Asphyxia (not fatal) 1 per cent, apnœic 2 per cent., and crying 97 per cent.

Case reports.—From service on Fifth Floor (O'Reagan).

With the present technique pain is materially decreased in all cases and in a few entirely eliminated; and labour is not, as a rule, delayed or prolonged any more than it would be if the drugs were not used.

From service on Sixth Floor (Cowan).

July 13th, 1923. Mrs. R. W., multipara.

All previous labours normal. Severe pain every two or three minutes, and lasting for one minute. Cervix two fingers

dilated, thick and soft. Ampoule of magnesium sulphate given at time of instillation. Distinct sedative effect lasting four and a half hours. Patient stated she felt very little pain, but was conscious that contractions were continuing. Second ampoule of magnesium sulphate given but no decided effect. Patient had fairly strong pains for two and a half hours before delivery. Baby crying when delivered.

Conclusion. Morphin should have been given with first ampoule of magnesium sulphate, but instillation should have been delayed until cervix was dilated to about three fingers.

July 31st, 1923. Para-1, Mrs. I. V.—Coloured.

Moderate-sized woman, who co-operated well. Strong pains every two minutes lasting 15 seconds. Cervix three fingers dilated, soft, thin. Hypodermic 2 cc. magnesium sulphate 25 per cent. solution, and at same time instillation was given, syringe method. Whole amount retained. Distinct sedative effect. Pains practically subsided, but patient felt contractions continuing. Patient dilated fully with the synergists. No nausea or vomiting. Patient delivered one and a half hours after instillation. As head was passing over perineum patient had considerable pain for five minutes. Excited. First degree laceration. No chloroform given except for repair. Baby crying when delivered.

Conclusion. This patient should have had morphin with first hypodermic, and also chloroform during last five minutes of delivery.

July 14th, 1923. Mrs. L. S., para-1.

Medium size, pains every five minutes, fairly strong and lasting 15 to 30 seconds. Cervix three and a half fingers dilated, soft, but not obliterated. Hypodermic and instillation given at same time. Sedative effect lasted three and twenty-five minutes, when hypodermic was repeated with good synergistic effect. Thirst and vomiting present. Cervix dilated from three and a half fingers to full. Delivery was spontaneous, four hours and thirty-seven minutes after instillation, and with only one hard pain while head was passing over perineum. No laceration. No chloroform used. Patient

drowsy for one hour following delivery. Child crying and normal.

July 22nd, 1923. Mrs. C. C., para-1.

Moderate-sized woman, having pains every five minutes and lasting 15 seconds. One ampoule of magnesium sulphate 2 cc. 25 per cent. solution with $\frac{1}{6}$ grain of morphin was given when cervix was dilated two to two and a half fingers. Instillation given by syringe method when cervix was three fingers dilated—soft, but not obliterated. Whole amount retained. Two and a half hours afterwards hypodermic magnesium sulphate 25 per cent. solution. Patient co-operated well. Sedative effect marked, as evidenced by sleepy appearance and little pain, but patient stated she felt contractions continuing. Some nausea and slight vomiting. Cervix dilated fully. L.O.P. position rotated to L.O.A. and was delivered spontaneously about four and a half hours after instillation. Patient had severe pains during last five or ten minutes. First degree laceration.

Conclusion. A very good result, but this patient should have had chloroform the last five minutes while head was passing over perineum.

July 18th, 1923. Mrs. V. H., primipara.

Large, heavy type of patient, having hard pains every minute, very noisy and complaining especially of backache, which was almost unbearable. Cervix dilated two fingers. A hypodermic of morphin sulph. gr. $\frac{1}{6}$, dissolved in 2 cc. of a 25 per cent. solution of magnesium sulphate, given. The second ampoule of magnesium sulphate without morphin was given one hour later. (Some relief, but patient still complains of pain.)

Rectal instillation given one and a half hours after *first* hypodermic—cervix thin and dilated three fingers. At first slight irritating effect—sedative effect beginning 15 minutes after instillation. Backache ceased immediately, pains less severe, but patient was unconscious—contractions were still going on. Cervix dilated fully in 45 minutes and delivery in one hour and 45 minutes after instillation. Baby crying and normal in every way. No anæsthetic used while head was

passing over perineum, and delivery was accomplished practically with no pain—no laceration. The analgesic effect was still present after delivery as evidenced by piercing perineum with towel clip without causing pain. No post partum hæmorrhage.

Conclusion. No such ideal results can be expected in all cases.

SUMMARY.

1. Labour is not delayed, for while the pain is relieved the contractions continue in over 98 per cent. of the cases.

2. The condition of the baby is not affected by the medication.

3. Ether administered colonically to the mother is safer from the offspring's standpoint than is sufficient morphin to produce the same effect.

The monument to Morton, erected by the State of Connecticut and the City of Hartford in Mount Auburn Cemetery, bears the following inscription :—

WILLIAM THOMAS GRIEN MORTON,

Inventor and Revealor of Anæsthetic Inhalation, Before Whom in all Time Surgery was Agony, By Whom Pain in Surgery was Averted and Annulled, Since Whom Science has Control of Pain.

Close watch the flowing crimson tide,
With touch upon the pulse applied
To know its meaning well.
If it go fast, if it go slow
Its number, rhythm, tension know,
For they the life gauge tell.

The hues that mantle on the cheek
Conditions of the blood bespeak,
Observe with anxious care.
Then ever keep the mind at work,
Nor let it tire nor let it shirk,
Nor wander otherwhere.

Note well sleep's elder brother,—Death
Awaits the shallow faltering breath.
Beware the open pupil, still;
Beware the muscles that are lax,
The jaw that lags or tumbles back,
Such symptoms bode but ill.

That man is blind as he can be
Who seeing all there is to see,
Observing does not understand.
Then keep the mind alert and keen,
Quickly decide on what is seen,
All things hold firm in hand.

Be not o'er timid nor o'er bold,
As coward or as dolt enrolled.
Maintain an even sleep,
The surgeon then will give you praise,
The patient too will bless your days,
And you your job will keep!

If things go wrong, be calm and cool,
Be rattled not, nor play the fool,
Work on a well-laid plan.
And in the end have sand and sense
To ask a proper recompense,
Be reckoned as a man!

F. D. BULLARD, Los Angeles, Cala.

In the *Am. Journal Surgery*, Anæsthetic Supplement.

SOME SPECIAL METHODS OF ADMINISTERING ANÆSTHETICS.

By H. P. Fairlie, M.D.

IN choosing the above subject I have in view some of the more recently introduced methods of administering anæsthetics, methods which require more elaborate apparatus and technique than those in common use. I have been moved to do so by reason of frequent criticisms of these newer methods. Many men question the value of all the additional paraphernalia which they involve, and cite the drop bottle and a piece of lint as being good enough for them. Far be it from me to decry simplicity in administration. The drop method, with its modest requirements in the way of apparatus, holds the field as the best for routine use, and so far no more generally satisfactory method has appeared to dispute its claim. At the same time, the specialist in anæsthesia would be foolish to ignore the other means at his disposal. Neither is it my intention to uphold all the complicated and cumbersome methods which, during the past twenty years, have been hailed as the last word in anæsthesia. Some of them, after a brief existence, have found a place on the shelf. There are to-day, for instance, very few exponents of intravenous anæsthesia. The complicated apparatus, prolonged preparation of sterile solutions, and intricate technique which it involved have combined to lead to its disuse in face of more trustworthy competitors.

There are, however, a number of special methods which have established their claim to a definite place in anæsthesia, and with four of those I wish to deal briefly. They are—Gas and Oxygen, Intra-tracheal, Spinal and Rectal Anæsthesiæ. All of them require considerable elaboration of apparatus or technique, or both, and yet each possesses a strong claim for employment in its own special field. My purpose in writing this paper is to outline the special cases in which I prefer to use each of those anæsthetics, and to give my reasons for the choice, with a few illustrative cases.

Gas and Oxygen Anæsthesia.

I ought to preface my remarks on this anæsthetic by stating quite frankly that I rarely use it alone. In nearly every case I prefer the patient to have a preliminary narcotic, morphia or heroin given if possible in two doses. In many cases I accompany it with small quantities of ether, and, in abdominal operations, its best results are obtained in combination with local anæsthetics, the surgeon using a weak novocaine solution as he goes along. The objection is frequently made that such an anæsthesia, especially if ether be used, is not entitled to be called "gas and oxygen" anæsthesia. Strictly speaking, the criticism is justified, but with preliminary narcotics and local anæsthesia, if need be, the quantity of ether used is so small as not seriously to complicate matters. It is quite certain that, using the minimum quantity of ether, the resulting anæsthesia is much more satisfactory as regards after effects than a straight ether anæsthesia.

As regards its scope, it would probably be used as a routine method were it not for one great disadvantage, viz., its cost. For an administration of any length this factor seriously militates against its more general employment.

The classes of special cases in which I find it of value are three—(1) patients suffering from shock, (2) patients debilitated from any cause, where the administration of any anæsthetic presents a problem, and (3) patients who have had violent sickness after former ether or chloroform administrations.

Cases.

(1) As an example of the first class, I might cite the case of a male patient, aged 18, who had a sarcoma of the femur, disarticulation at the hip. Morphia $\frac{1}{4}$ grain was administered one hour before operation. Induction with gas-oxygen and ether. Ether turned off at five minutes and not required thereafter. Satisfactory anæsthesia throughout. Although the operation, lasting 55 minutes, entailed a considerable amount of shock the patient's condition never gave any cause for anxiety. Recovery was uninterrupted and unaccompanied by sickness.

(2) A woman of 75, frail and thin. Operation for removal of gall-stones from gall bladder and common duct; gall bladder drained. Heroin 1/12 was given four hours and one hour before operation. Ether was used for two minutes during induction and three times subsequently for one minute each time. Novocaine ½ per cent. solution was injected locally in subcutaneous and deeper tissues by the surgeon at commencement of operation. Anæsthesia lasted for 75 minutes, and the operation, despite the feebleness of the patient, caused little disturbance. The patient made a good recovery, with slight sickness during the first twelve hours.

(3) A man of 48, in good condition, who had twice previously had anæsthetics and was violently sick after both. Operation for left inguinal hernia and varicose veins, lasting 75 minutes. Heroin 1/12 was given three hours and one hour before. Ether for six minutes at commencement and three times subsequently for half a minute periods during the first half hour, then not required further. Uneventful anæsthesia and recovery without vomiting. In this case the fear of the after sickness and consequent discomfort was sufficient to make the patient very nervous about the anæsthesia, and the complete freedom from it was all the more appreciated. It is only fair, however, to state that in other similar cases gas-oxygen has not proved so successful, a few patients having had troublesome after sickness.

Intra-tracheal Anæsthesia.

Chloroform, ether or mixtures may be used by this method. The apparatus I used for chloroform (*Glasgow Medical Journal*, Dec. 1917) did not prove completely satisfactory, and latterly I have been using ether exclusively. There is now, however, a very good apparatus on the market which allows of chloroform, ether or mixtures being administered, with accurate percentage control, its only disadvantage being its bulk.

Again the cases may be divided into three classes:—

(1) The surgery of the lungs.

(2) Operations about the neck where there is pressure from tumour, or the probability of pressure during the operation, *e.g.*, goitres, glands, branchial cysts, etc.

(3) Operations in the mouth, nose or about the face, where advantage is obtained (*a*) from the return stream of air keeping the airway unobstructed by blood, and (*b*) from the anæsthetist being able to keep away from the field of operation.

Of class (1) I am not qualified to speak, having only twice had the opportunity of testing this method in lung operations. Both were cases of bronchiectasis in children. The first died from drowning in his own secretion before the tracheal tube could be passed. The second was successful.

(2) A woman of 22, thin and rather nervous, with an exophthalmic goitre. In such cases the anæsthesia is rendered very much easier, and the anæsthetist's anxiety very considerably relieved, by using intra-tracheal anæsthesia. Induction by open ether and a No. 22 catheter passed through the laryngoscope. The resulting anæsthesia was excellent, lasting for 90 minutes, and allowing of the manipulation of the thyroid involving traction and pressure on the trachea. There was free hæmorrhage. The patient made a good recovery.

Again, in this class the administrator is relieved of worry in a way that no other method can achieve. As an example, I will quote the case of a man of 30, who had a plastic operation for restoration of the nose destroyed by lupus. The operation was performed in two stages, the first lasting 55 minutes and the second three hours. In both the anæsthesia was satisfactory, the airway being kept unobstructed by blood, and I being enabled to keep clear of the surgeon and assistants.

Spinal Anæsthesia.

My preference for this anæsthesia is in deep intra-pelvic operations where the very complete relaxation it produces is of great value, while the results are obtained without high injection, and shock is reduced. The operation, *par excellence*, where I find it valuable is a Wertheim. In such operation I generally use gas-oxygen in combination, owing to the discomfort of the Trendelenburg position to a conscious patient. The following is a record of such a case:—

A girl of 19, with a cancer of the cervix. Morphia $\frac{1}{4}$ and atropine 1/100 one hour before operation. Injection of $1\frac{1}{2}$ cc. of Barker's heavy stovaine solution at first lumbar interspace,

then Trendelenburg position for three minutes. Anæsthesia to two inches above umbilicus in five minutes. Gas-oxygen with ether started at six minutes, and ether stopped at nine minutes. Trendelenburg position again at 15 minutes when the operation was commenced, lasting for one hour. During that time relaxation was complete, although general anæsthesia was maintained at a minimum, and twice slight retching occurred. The patient's general condition was good throughout, and recovery till time of departure from hospital was uninterrupted. Sickness only occurred once after operation.

In my series of spinal cases I have seen none of the severe sequelæ which occur. Some patients have complained of headache for a few days, but none have developed paralytic symptoms. This may be due to the fact that I have always injected low, in the lumbar region. In one case a very grave cardiac collapse happened. A man of 65, in good condition, was to be operated on for an enlarged prostate. He had ¼ grain morphia one hour beforehand, 1½ cc. of Barker's heavy solution injected at the 2nd lumbar interspace, and patient placed in the Trendelenburg position for two minutes. Anæsthesia extended up to the umbilicus at four minutes. At six minutes gas-oxygen commenced, and ether added at seven minutes. At ten minutes, while the skin was being prepared for incision, the patient suddenly collapsed, becoming almost pulseless, pale and clammy, and stopped breathing. He was put in the Trendelenburg position at once, oxygen administered and artificial respiration commenced. Recovery, up to a point, was rapid, and after a few movements of artificial respiration breathing was re-established. The pulse, however, remained weak, and for about six hours his condition remained serious, after which he recovered. The operation was postponed and performed a week later under gas-oxygen with local anæsthesia.

Rectal Anæsthesia.

My experience of rectal or colonic anæsthesia is limited, but in such cases as the following it is probably the most satisfactory means at our disposal. A boy of 15 was admitted to hospital with a nail in one of the right bronchi. He was anæsthetised several times with chloroform on a Schimmel-

busch mask followed by warm ether by Shipway's apparatus, while the bronchoscope was introduced. The anæsthesia was unsatisfactory, and had to be intermittent in order to allow the surgeon access without anæsthetizing him as well as the patient. As the difficulties in this respect proved so great I decided to use rectal ether; 4 ounces of a 60 per cent. solution in olive oil were injected, and in 15 minutes the patient was sufficiently anæsthetized to allow of the bronchoscope being passed. With the aid of a little ether occasionally by means of Shipway's apparatus a satisfactory anæsthesia was easily maintained, allowing the surgeon complete freedom of action.

I have quoted the above cases in the attempt to show that there are times when special methods of administering anæsthetics are distinctly advantageous. The drop method has its place, but by no means always does it rise to the requirements of modern surgery.

" The anæsthetist is a man apart. He has to undertake the same trust as the surgeon; the patient's life is in his hands. The ease and perfection of an operation largely depend upon his skill in giving the anæsthetic. He acts without speaking, and his demonstration of his art is mute. The patient, whose pain he prevents, has only time to say ' Good morning,' before becoming unconscious of the benefit he receives, and ere consciousness has completely returned the benefactor has departed. The anæsthetist appears as a prologue to the operation, and then becomes an influence pervading the whole action, having an important but silent part in it, and at the end vanishing strangely."—Moore, Norman : " History of St. Bartholomew's Hospital," vol. 2, p. 750, 1918 edition. C. Arthur Pearson, Ltd.

The following officers have been elected for the ensuing year by the Canadian Association of Anæsthetists : President, Dr. Walter I. Muir, Halifax; Vice-President, Dr. John J. J. Buettner, Syracuse, N.Y.; and Secretary Treasurer, Dr. Harry J. Shields, Toronto.

ON THE TEACHING OF ANÆSTHESIA TO MEDICAL STUDENTS.

By Wesley Bourne, M.D., C.M.,
Lecturer in Pharmacology, McGill University.

TO advance anæsthesia in medicine we believe that those interested in the subject must do more research work and better teaching. The quality of the latter is affected by the former. Realising these, we have, during the past three years, made some improvement at McGill University.

In research the anæsthetists work individually, but in teaching collectively for the purpose of establishing unanimity of doctrine. The student is given his first instruction in anæsthesia in the fourth year during the course in pharmacology. Here, after the theory of anæsthesia has been discussed and the behaviour of certain narcotics has been studied in the laboratory, Professor Barbour allows the anæsthetists to conduct the activities of one week in which there are two lectures of one hour each, one laboratory period of two hours, one demonstration, and, lastly, one conference of one hour. The two lectures are didactic, and deal with the details of the pharmacological actions of the general anæsthetic agents commonly used.

At the laboratory period the students, in groups of four, do the work themselves under the supervision of demonstrators. Dogs are used, half of which have had no preliminary medication, the other half being under the influence of morphine (10 mg. per kg.). It has been customary to induce anæsthesia with ether given by a cone and continued by a tracheotomy tube, a branch of which was connected to a tambour for tracings. Carotid blood pressure was also recorded on the kymograph. Now that the Department of Pharmacology has moved to the new biological building, the procedure for this present session is planned in which the observations will all be made by bloodless methods and mortality reduced to a minimum. The students will be able to maintain anæsthesia by intra-pharyngeal insufflation, and

will follow the circulatory changes by auscultation, as well as by tracings on the kymograph, using a modified Kolls blood pressure cuff recently devised by Dr. Joseph Kaufmann and the author.

With the aid of a synopsis the students are allowed to study the pulse and respiration of normal or morphinized dogs, to induce anæsthesia with ether, using a wooden cabinet which has one side of glass and two openings. One admits air under pressure which carries with it anæsthetic vapour, and the other acts as an exit. Here they note the behaviour of the animal, the reflexes, the movements and position of the eye-balls and movements of the larynx, they mark the stages of anæsthesia and locate the strata of the third stage, and observe the time required for complete anæsthesia.

The animal is now removed from the cabinet and tied on a heated table and anæsthesia maintained by pharyngeal insufflation by passing the tube, which was attached to the cabinet, through a wooden mouth gag to the pharynx. A pneumograph is now adjusted for respiration tracings, and the blood pressure cuff placed on a hind leg, so connected that tracings may be recorded. And now detailed observations may be made under the following conditions:—Light ether anæsthesia, insufficient aeration, a change from light ether anæsthesia to chloroform, deep ether anæsthesia, insufficient aeration again, a change from deep ether anæsthesia to chloroform, after which insufficient aeration once more and then deep chlorform anæsthesia. We avoid the usual instructions of chloroform poisoning. However, should respirations cease, methods of resuscitation are done, such as stretching of the anal sphincter, artificial respiration, cardiac massage, intravenous injection either of epinephrine, 0.1 mg. per kilo mixed with 50 cc. normal saline, or caffeine sodio-benzoate, 50 mgms. per kilo.

The students are called upon to tabulate the observations made under the various conditions enumerated, and to compare as well the differences between the morphinized dogs and those without morphine. Further emphasis is laid upon a comparison of ether with chloroform.

At the demonstration they are shown how anæsthesia may be smoothly induced and conducted in a dog even without

preliminary medication. The animal is placed in a large glass case which has two openings. One permits of connection to an insufflation apparatus, the other acts as an outlet. Air is pumped in to which ether vapour is gradually added. The student becomes impressed with the quietude of this induction, for the animal becomes anæsthetized without struggle and with comparatively little increase in muscular movement in from two to four minutes. It is then quickly removed and placed on a heated table, and with the aid of a Chevalier Jackson laryngoscope intubation is done and anæsthesia maintained by continuous intra-trachael insufflation under low pressure. Blood pressure is observed, as mentioned above. Tracings of respiration are made by a T-tube connection to the intra-tracheal tube. This demonstration affords a further opportunity for explanations of many important details of anæsthesia.

The conference consists in a review of the week's work, when the students are asked and allowed to ask questions.

The practical applications of anæsthesia are taken up in the following fifth year during the course in Clinical Pharmacology. Two lectures are devoted to anæsthesia and such matters are discussed as the choice of anæsthestic agents and methods, the preparation of the patient, the details of conduction of the anæsthetic period and after care. Lantern slides are used to illustrate Guedel's sign chart, some typical anæsthesia charts and several of the more important anæsthetic implements and machines. One gas-oxygen machine is demonstrated in detail.

Practical work is exacted of the students during the final year. Each student must administer anæsthesia himself at least four times, and make in each case a full report to his instructors on what is known as the McGill anæsthetic record here illustrated. Again, in each large hospital an anæsthetic clinic is given once during the session when several short operations are performed and as nearly as possible all of the various anæsthetic agents and methods demonstrated, the surgeons allowing the anæsthetists to hold the floor. The students are encouraged to participate further in the giving of anæsthetics as opportunity offers, and many graduate with fifty or more anæsthesias to their credit.

CGILL ANÆSTHETIC RECORD ..... Hospital

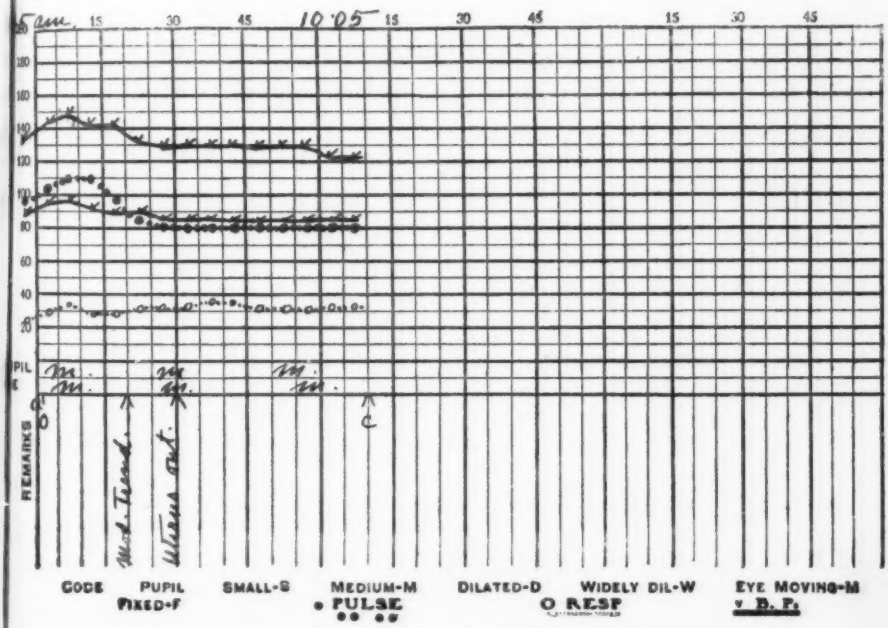
NAME M. AGE 32 SEX

SURGEON Dr. DATE 23-8-22 WARD

ERATION Hysterectomy + Appendectomy	INDUCTION SMOOTH, DIFFICULT, STRUGGLING
CIAL CONDITIONS PRESENT Fibroid	HOLDING BREATH, SPASMODIC OBSTRUCTION
	CYANOSIS, COUGH, TREMOR
ESTHETIC N_2O + O.	CONDITION AT CLOSE Good.
THOD Closed.	
PARATUS	
. MORPH. 1/6 AT ROP. 1/150 SCOP. 0.	RECOVERY IMMED. EARLY, DELAYED,
EN AT 8 O'CLOCK am.	AFTER EFFECTS
RATION ANÆS 1 hr. + 10 mins.	NAUSEA, VOMITING, NONE, SLIGHT, MOD. SEVERE,
RATION OPERATION same.	COUGH, once immediately
ITION Trendelenburg's	
M None.	
FUSION O INTRAVENOUS None	
SUBCUTANEOUS None.	

REMARKS

Anæsthetist.



For the routine administration of ether we use in all of our hospitals the McGill modification of the Ferguson mask, and for which Dr. W. B. Howell deserves most of the credit. For reference text-books we recommend Solmann's "Pharmacology," Cushney's "Pharmacology," and works on anæsthetics by Buxton, Gwathmey, Flagg, Hewitt and Silk. In this connection, in the near future, we hope to have prepared a small book on anæsthesia to be used as a practical guide by students and to be known as the McGill Handbook of Anæsthesia.

To us it is particularly encouraging to note the increasing interest shown by the majority of students, some of whom are now asking to be admitted as house anæsthetists at graduation. This should offer a real solution to the difficulty in obtaining qualified graduates in medicine to administer anæsthetics.

A Diploma in Anæsthesia.

With the steady advance of our speciality the time is rapidly approaching when its status, after the completion of a satisfactory course of higher instruction, would warrant the granting of a Diploma in Anæsthesia.

For those who desire to prepare themselves properly to undertake the uncommon and intricate procedures necessary in what may well be called the higher grades of the practice of anæsthesia, a special course of instruction of from three to six months in a well equipped hospital and university would be more than worth the time and expense, especially if the reward of close application proved the attainment of a diploma.

The first three months could be spent at certain specified hospitals where special demonstrations might be arranged, but the final three months should probably be confined to one such centre as the University of Cambridge.

Candidates for the diploma would, of course, hold a medical qualification, and be required to do a certain amount of practical anæsthetic work.

THE VALUE OF THE REFLEX BASIS IN THE INTERPRETATION OF PHENOMENA DURING GENERAL ANÆSTHESIA.

By S. R. Wilson, M.B., M.Sc., F.R.C.S.E.

Senior Anæsthetist, Manchester Royal Infirmary; Lecturer in Applied Physiology, Victoria University, Manchester.

OF late years there has been a tendency to look upon disturbances of bodily function from the reflex basis, for the healthy workings of most parts of the body are dependent upon the integrity of their particular reflex mechanisms, and the latter have also been elaborated through the ages with the additional object of providing these same organs with a protective apparatus. This principle applies to a still greater degree to subjects in a state of general anæsthesia for such activities as still remain are essentially reflex, and whilst it is true that these reflex functions may be thrown out of action by deeper anæsthesia we have further to consider whether in some cases harm may not result.

In any case the reflex basis offers a sound and complete explanation of many phenomena observable during the course of surgical operations conducted under general anæsthesia, and it will be my endeavour to demonstrate this by considering in detail well-known phenomena occurring during operative manipulations which I have now studied for many years, and attempted to explain on a physiological basis.

It has been my habit for some time, whilst instructing students in general anæsthesia, to emphasize to them the importance of reviewing the patient's condition just before the operation commences and to satisfy themselves that their patients are in a safe condition. One first draws attention to the fact that there are three fundamental systems as regards life, viz.:—

The Respiratory System,
The Circulatory System,
The Nervous System,

and accordingly there are three fundamental modes of death corresponding to failure of these same functions. It is true

that other organs such as the thyroid and pancreas are necessary for life, but it is these three systems the *continued action of which is necessary for life* during general anæsthesia. One is fully aware that transient stoppages of these systems may be satisfactorily surmounted but one should beware of such stoppages especially if prolonged, for though life may be restarted, subsequent ill-effects may supervene. For instance a heart which has stopped beating may be resuscitated by cardiac massage, but if more than a few minutes delay be allowed a fatal result is prone to occur later from cerebral convulsions due no doubt to permanent changes in the central nervous system, the sequel of too prolonged cerebral anæmia.

Let us consider then these three systems in turn. First of all is the breathing efficient? The usual answer one receives is "Yes," because they can observe the respiratory movements. Now such movements simply prove that the respiratory centre is still acting and are no proof of respiratory efficiency; in fact as a rule the more vigorous the movements the greater the inefficiency, for the respiratory centre will show exaggerated movement even in advanced asphyxia. The lungs are simply organs of respiratory exchange and respiration as a vital process occurs in every living cell in the body. The true test of respiratory efficiency is seen in the colour of the ear. If the ear is pink oxygen is getting to the tissues in sufficient amount. Should the patient be very anæmic the ear may be very pale but by rubbing it gently a few times between the fingers and thumb a pink colour is readily produced and will serve as an index for the test. Should the head and neck be covered up the condition of the blood in the wound will furnish one with the necessary evidence.

Having satisfied ourselves that the breathing is efficient we have then to investigate whether the circulation is satisfactory. One can best do this by assuming what would happen if the circulation failed. If the heart fails suddenly there will be pallor. If it fails gradually cyanosis. But here a possible fallacy should be noted. If the patient's head is lower than the rest of the body, as in the Trendelenberg and lithotomy positions and even in the horizontal position, blood may remain in the ear by gravity and give a fallacious appearance of a circulation when none exists. To correct this we apply a

further test, known as the skin reflex or colour reflex. Press on the ear with the fingers until a white patch is produced. On removing the pressure the pink colour will immediately return if the circulation is active. If the white patch persists the circulation is stagnant. Though called a reflex this test is not a reflex at all but a mechanical test of the pressure in the capillaries and fine arterioles. In other words it is a "reflux."

The remaining system to consider is the nervous system. How are we to tell whether this system is in a healthy and satisfactory condition? "By means of reflexes." Suppose one is walking along a country road and a frog lies motionless in our path. Is it alive or is it dead? Touch it and it jumps. "Where there's a reflex there is life." Whilst the absence of many reflexes may not necessarily indicate danger yet their presence is of great value, for as long as there is a reflex one can expect to readily resuscitate the patient. If then one enquires what reflex, the answer is "any reflex." It is true that most attention has been paid to the ocular reflexes, partly because they are usually readily accessible to the anæsthetist, partly because the reflex nuclei concerned are situated between the cerebrum and the medulla, and one desires to depress the former whilst preserving the activity of the latter. It may be pointed out, however, that the latter conception is not quite true. Administrators are familiar with the change in the type of breathing when the patient passes into the stage of surgical anæsthesia, and this is to be explained by the fact that the reflex control of the respiratory centre is depressed and its activity is largely maintained by chemical stimulation from the blood. One should beware of too frequent testing of the ocular reflexes especially in early stages as they are readily exhausted and after-irritation of the eyes may supervene. Reflexes elicited by surgical manipulations, reflex contractions of muscles, grunting and phonation will generally supply the necessary information.

Having verified that the fundamental systems are in a satisfactory condition and that the patient has reached a stage of ordinary surgical anæsthesia, a condition of safety and tranquility appears to have been reached, but the supervention of certain surgical manipulations makes us realise that this

is far from being the case and the explanation of these disturbances is to be sought on reflex grounds. For illustrative purposes it is proposed to consider and explain a few well-known manifestations, but a similar application will easily explain other allied phenomena. The special cases about to be considered are :—

(1) The Expulsive Reflex.
(2) The Rectal Cry.
(3) Ocular Complications.

1. *The Expulsive Reflex.*

The upper abdominal or epigastric reflex is familiar to all students of medicine and consists of lightly stimulating the skin over the upper abdominal wall and producing a reflex contraction of the underlying muscular segments. Reflex rigidity of these segments also occurs in disease involving the lining membranes of the corresponding visceral segments and was designated by Mackenzie as the "viscero-motor reflex." There are additional points in connection with reflex action which become of importance in surgical work. In the first place the reflexes become of a nociceptive character, that is to say they assume an intense form with a view to protecting the body from injurious stimuli. Secondly with the removal of higher centres, reflexes tend to diverge from their localised form and overflow into channels not normally associated with the reflex and assume the characters of a mass reflex, *i.e.*, the contraction is no longer limited to the particular segments stimulated but tends to spread to and involve all the neighbouring musculature giving rise to general abdominal and even thoracic rigidity. In an operation on the upper abdomen under general anæsthesia the conditions are ideal for the production of the epigastric reflex, as a mass reaction and its nociceptive character becomes intensified by rough surgical manipulations. Now this reflex was designed by nature as a protection for the upper abdomen and its contents from external injury, and in making this provision modification of the part from surgical interference was entirely ignored. In consequence a reflex which normally produces a tense contraction of the abdominal wall with the protection of subjacent viscera, tends on account of the presence of a gap

in the parietal peritoneum to lead to extrusion of the abdominal contents so that under these modified conditions the upper abdominal reflex becomes an expulsive reflex and as such is a source of worry and trouble to both surgeon and anæsthetist. Appreciation of these facts should help us to eliminate or, at any rate, to alleviate its undesirable effect on the surgeon's work. Full muscular relaxation should be obtained before the operation is commenced, the anæsthesia should be kept absolutely uniform and to a depth at which the corneal reflex is just abolished and the surgical manipulation should be gently performed. It is generally believed that the visceral peritoneum is insensitive, but the handling of an organ and its visceral peritoneal coat results in inevitable traction through its peritoneal connections on the parietal peritoneum which readily elicits the reflex. Anoci-association by the interruption of the lower reflex arc which it produces readily solves the difficulty, as also will infiltration of the recti muscles with novocaine. We are, however, more immediately concerned with the explanation of the manifestation than its treatment and accordingly the second example will now be considered.

2. *The Rectal Cry.*

All students of anæsthesia, even from its early days, have noted the characteristic inspiratory crowing sound which occurs at the commencement of rectal operations when the sphincter of the rectum is dilated. To this sound the name of the " rectal cry " has been given and attempts were made to determine some anatomical association between the rectum and the larynx. The sphincter ani is supplied by a branch of the internal pudic nerve which comes from the 2nd, 3rd and 4th sacral nerves, whilst the larynx is supplied by the vagus, The only anatomical connection is the spinal cord, which at once suggests the possibility of a reflex explanation. Now each viscus is anatomically and physiologically designed for the performance of certain definite functions which are largely controlled on reflex lines. The rectum is essentially designed for the purpose of defæcation and a complicated reflex has been elaborated to this end. Under ordinary conditions the act of defæcation broadly comprises the following sequence of

events. There is first of all a deep inspiration, followed by a closure of the glottis. This leads to fixation of the diaphragm and is followed by contraction of the abdominal muscles, with the consequence that some of the contents of the large intestine are forced into the rectum. The presence of a foreign body in the rectum causes peristalsis of the large intestine, contraction of the coats of the rectum, dilation of the sphincter and extrusion of the rectal contents. All these manifestations occur as one single highly elaborated reflex.

Let us consider what happens when the rectal cry is produced. The surgeon dilates the *rectal sphincter*, in other words he artificially performs the last phase of this complicated reflex. The centres are stimulated and the reflex is called into action but in a reverse order. In consequence we get closure of the glottis followed by a long drawn inspiration with a result that a long drawn crowing inspiratory sound is produced. The rectal cry is to be explained then as a *reversible reflex* artificially produced by a certain surgical manipulation.

3. *Ocular Complications.*

Infection of the eyes, conjunctivitis and even corneal ulceration are possible complications which may supervene after the administration of a general anæsthetic and are usually explained as due to introduction of anæsthetic liquid or vapour into the eye, to lack of cleanliness of the fingers and to too excessive zeal in the testing of the ocular reflexes. Whilst these explanations no doubt suffice in a large number of cases, the writer observed certain administrators produced redness of the eyes and conjunctivitis in their patients with undue frequency. He carefully observed them at work and excluded all the above-mentioned causes only to find vivid red injection of the conjunctiva at the end of the administration. What was the explanation?

Consider the outstanding features of inflammation. We are all aware that irritation of the web of a frog's foot with mechanical, chemical, or other stimuli produces inflammation, also that in the case of the mesentery mere exposure to air will suffice. That is to say in the case of a delicate membrane mere exposure to air is sufficient to set up an

inflammatory change. Now the conjunctiva is a delicate membrane and mere exposure to air would produce such a change were it not provided with a defensive mechanism. There is evidence of this in the ocular changes which may occur after removal of the Gasserian ganglion, and surgeons are in the habit of washing out the eyes with antiseptics and stitching the lids together before performing this particular operation.

Why has this operation such a deleterious effect upon the eye if the ganglion be completely removed?

Because it destroys the reflex arc, and upon the integrity of this reflex arc the defensive mechanism depends. If one looks around during an operation and observes the eyes of those present one will notice that two or three times per minute the eyelids blink. This blinking reflex supplies the eye with a defensive mechanism, it removes fine irritant particles and swills the lachrymal secretion over the front of the eyeball.

If the administration of a general anæsthetic be prolonged, the corneal reflex and lachrymal secretion abolished, then if the lids remain partly open, redness and irritation of the conjunctiva will supervene for the protective blinking reflex and its accompanying secretion is eliminated. At this point it is advisable to draw attention to the varying states of the eyelids during general anæsthesia.

If the anæsthesia is slight the eyelids are tightly closed, if ordinary muscular relaxation is present the eyelids are slightly open, $\frac{1}{8}$–$\frac{1}{4}$ inch, if there is profound relaxation, shock, or the subjects be old people, the lids are widely open. As regards prevention. In addition to avoiding introduction of anæsthetic into the eye and too frequent testing of the reflex, one may introduce a drop of castor oil if the cornea is dull and secretion deficient, but this is not usually necessary. One should from time to time roll the upper lids over the globes of the eyes and approximate the lids and the trouble will be readily surmounted.

Many other instances in which a study of reflex action is of great assistance have also occurred to the writer. For example, in ordinary surgical anæsthesia the knee-jerk is lost showing that the anæsthetic acts upon the lower reflex arc and yet the efferent side of the arc cannot be paralysed, for

one observes the muscles twitch if the motor nerve be stimulated during the operation, so that the anæsthetic must be acting on the afferent side of the reflex arc. A simple observation but one which should make us to doubt whether such graphic statements that "surgical shock is due to bombardment of the cerebral cortex" can possibly be true, particularly when it is stated that nitrous oxide and oxygen are more efficient in the prevention of shock than ether, and yet the former reagent does not depress reflex activity to anything like the same degree as ether, and the cortex of the brain has been shown to be more excitable under nitrous oxide and oxygen anæsthesia than with other general anæsthetics (Jackson).

It is hoped that this article will direct attention to the value of applied physiology in general anæsthesia and lead to the accumulation of more and more scientific data in this progressive art.

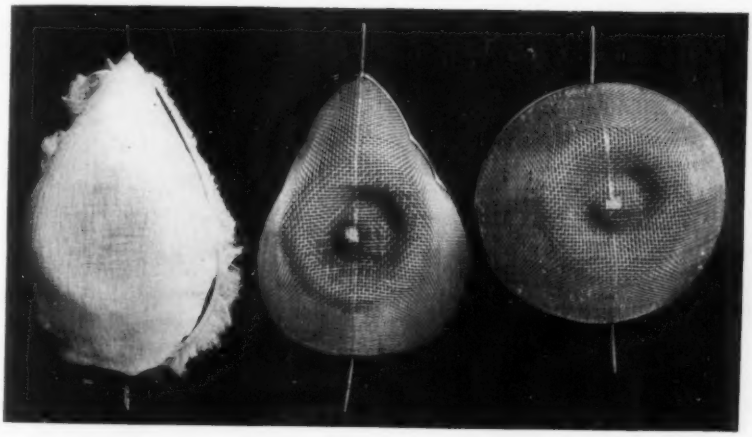
AN IMPROVED OPEN ETHER MASK.

The illustration opposite indicates a simple way in which an open ether mask may be improvised.

The right-hand figure in the print is a gauze cone taken from the interior of a lady's hat box. The middle illustration represents the same after being moulded to a convenient shape in the hands, whilst the left-hand figure represents the mask covered with gauze, retained in position by means of a rubber band passed over the projections at each end.

The mask is rather larger than those in common use and has a cubical capacity of 500 cc., which corresponds to the tidal air of an average patient, and is sufficiently deep to avoid all contact with the nose, which many ordinary masks fail to do, whilst the depression at the top of the cone provides a convenient surface for dropping and localizing the ether, instead of the latter rapidly gravitating towards the face-pad. The mask was devised by Sister Hallett of the Elmfield Nursing Home, Manchester, and myself when short of apparatus for commencing the early inhalations for "stealing the thyroid" in a case of exophthalmic goitre.

S. R. Wilson,
Manchester.



THE NATIONAL ANÆSTHESIA RESEARCH SOCIETY OF AMERICA.

By E. I. McKesson, M.D., President.
Toledo, Ohio.

Quoting from the constitution of the National Anæsthesia Research Society:—

1. The objects for which this Society is formed comprise the collection, promotion and distribution of all forms of information concerning the manufacture, production, use, distribution and handling of any material or substance commonly considered to have anæsthetic properties.

2. The Society shall have as its further object to improve and advance the science and practice and teaching of anæsthesia by such means and to such extent as its resources may permit and its governing powers may direct.

At the time of its organization there was insufficient means for the distribution of current literature on anæsthesia and analgesia. There was a lack of co-ordination of the forces among colleges, researchers and practitioners of anæsthesia, so progress could not be economically maintained. There was a lack of funds also with which to distribute information, and, in order to meet these conditions, the National Anæsthesia Research Society included in its membership many individuals who "declared to the public that they were manufacturers of an anæsthetic or analgesia apparatus." From this latter section of the membership was derived thousands of dollars in the past years,—far beyond the ability of anæsthetists to contribute for the distribution of this information. The Bulletin of Anæsthesia and Analgesia represents one of these activities. The Monograph on Nitrous Oxide and Oxygen in Obstetrics another; still another is represented by the Congress of Anæsthesia which is to be held annually in some city where practical demonstrations can be carried out. Perhaps one of the most important activities, for its possibility of progress in the future, is a Research Week held in some

well-known, highly-equipped laboratory, in which problems of anæsthesia are brought to the attention of physiologists, chemists, pharmacologists, physicists, anæsthetists, all working together while getting the others' view-point. In 1922 this Research Week was under the management of Professor Jackson, of the University of Cincinnati. The work was done largely upon dogs, using various anæsthetics, and trying several new experiments with the co-operation of Professor Fisher, physiologist, Professor Mathews, biologic chemist, and other Professors of the institution. No formal report of these investigations have been published, but the results are appearing in the papers presented by various members of the class in their respective departments. It is hoped that the Research Week may bring together the investigator, the medical teacher and the practical anæsthetist, resulting no doubt in great improvements in the future.

The membership comprises almost everyone interested in anæsthesia in the United States and Canada, and many in other countries. Many of these devote the major portion of their activities to the speciality of anæsthesia. It is easily the largest membership in the United States, and represents no regional field.

Its board of governors consists of professional anæsthetists and business men interested in anæsthesia, its Secretary-Editor being F. H. McMechan, A.M., M.D., Avon Lake, Ohio.

ABSTRACTS OF CURRENT ANÆSTHETIC LITERATURE.

BRITISH MEDICAL ASSOCIATION,
Portsmouth, July, 1923.

SECTION OF ANÆSTHETICS.

(Abstracted from advanced proofs by courtesy of *British Med. Journ.*)

Discussion on *Anæsthesia for Children.* Abstract of opening paper by HAROLD SINGTON, M.D., M.R.C.S., L.R.C.P., Senior Anæsthetist, Hospital for Children, Great Ormond Street.

Dr. Sington discussed the subject under four headings :—

1. The preparation of the patient.
2. The choice of the anæsthetic.
3. A few points on administration.
4. The recovery period.

As regards preparation he emphasizes the importance of not starving the patient, and of avoiding purgatives. The toxic action of a general anæsthetic should always be borne in mind and a careful urinary examination made with a view to determining the presence of carboluria and acetonuria. He draws attention to the importance of Frew's work on the influence of diet on acetonuria, and summarizes the preventative measures which are advisable when acetonuria is present.

(1) The operation must be postponed until the acetonuria has been rectified by treatment.

(2) All cases, prior to being anæsthetised should have glucose as a routine for at least two days before operation. Glucose should also be administered during after-treatment.

(3) The patient must not be starved before operation.

(4) Aperients and purgatives must not be given before operation.

He recommends the preliminary injection of atropine half an hour before the anæsthetic but strongly condemns morphine.

As regards the choice of an anæsthetic he recommends as a routine open ether preceded by an injection of atropine. Chloroform should only be employed when the cautery is used. For congenital pyloric stenosis and intussusception gas and oxygen are advised, and statistics of the relative mortality of these conditions under different anæsthetics are given. Ethyl chloride is recommended for dental extractions in children.

Under the heading of administration of the anæsthetic, the importance of gentleness and tact in the management of the child is pointed out, and a warning uttered as regards the administration of the anæsthetic in bed, a proceeding which should be strenuously avoided.

Suggestions given as regards the recovery period are as follows :—

(1) A drop of castor oil in each eye, but not until the administration is over, otherwise the ether dissolves in the oil and irritates the conjunctiva.

(2) Sponge out the mouth with normal saline immediately the administration has ceased.

(3) A rectal sedative should be given as soon as the child is put back to bed. For a child of ten a suitable enema is :

Pot. Brom.	10 grns.
Aspirin	20 grns.
Normal saline	½ pint.

Fatalities from Anæsthetics. By A. L. FLEMING, M.B., Ch.B., Senior Anæsthetist, Bristol Royal Infirmary.

Dr. Flemming decided to treat the subject from a clinical point of view, seeing that statistics of death under anæsthetics were generally so lacking in essential details as to be of little use in application to practice.

The total number of fatalities has remained practically stationary in spite of an enormous increase in the number and severity of surgical operations.

He classified anæsthetic deaths into three groups according as to whether they occurred before, during, or after the operation.

The first group was due to the anæsthetic alone and most cases occurred from the use of chloroform in induction, which involves special risks especially if there is struggling or if the position of the patient is altered, for moving the patient may cause a fatal syncope.

Induction with chloroform must be looked upon as too dangerous for routine work. Ether may be administered slowly, or open ethyl chloride or nitrous oxide may be used to facilitate the induction.

The second group—those occurring during operation—is difficult to analyze owing to the numerous factors involved, but more intimate co-operation between surgeon and anæsthetist has helped to reduce their incidence. Whilst on occasion the surgical manipulation may be responsible for the patient's unfavourable condition, it is still the duty of the anæsthetist to notify the surgeon of the danger. A combination of local with general anæsthesia might on occasion avert the disaster. When a patient moribund from disease dies during operation it is misleading to attribute death to anæsthesia.

As regards the third group it is well-nigh impossible to fix the blame. The occurrence of shock or of chest complications is equally dependent upon the operative procedure as the anæsthetic, and these risks can only be lessened by consultation between surgeon and anæsthetist. The tendency to chest complications may be increased by a natural inclination to avoid a tragedy on the table, for the safest anæsthetic during the operation may prove the more dangerous in the long run.

Dr. Flemming drew attention to the difficulties involved in the teaching of anæsthetics, for the student devotes little time to this study, and occasional post-graduate lectures are of little value.

He then reverted to the danger of syncope during chloroform anæsthesia and pointed out that the chief contributory factors are (1) Interference with respiration; (2) the use of too concentrated a vapour.

Interference with respiration might be due to a faulty position of the jaw, or to muscular spasm, but there was a more insidious form of faintness due to accumulation of blood and mucus in the larynx, which was best got rid of by a cough. Deaths under chloroform have also occurred after the patient has been moved from one table to another. The change of posture during deep anæsthesia may cause a fall in blood pressure or in lighter stages to vomiting and faintness. The concentration of the vapour depends largely on the extent to which the air-way is kept free from obstruction.

Operation risks could be greatly lessened by the surgeon and anæsthetist working together to conserve blood-pressure and muscular tone. A fall of blood-pressure due to surgical manipulation will usually be followed by a return to normal if not allowed to persist more than fifteen to twenty minutes.

The question of muscular relaxation is a matter of arrangement between surgeon and anæsthetist but may be facilitated by injecting a local analgesic.

Occasionally deep anæsthesia is associated with a dangerous slowing of the pulse (30—40 beats per minute). In such cases one is justified in refusing to deepen the anæsthesia. Valuable information as regards chest complications might be obtained if a large number of anæsthetists could be induced to send reports of such cases to a special committee.

Anæsthesia by the gas-oxygen-ethanesal and the gas-oxygen-chloroform-ethanesal combinations. By H. Edmund G. Boyle, O.B.E., M.R.C.S., L.R.C.P., Anæsthetist and Lecturer on Anæsthetics to St. Bartholomew's Hospital.

Dr. Boyle opened his paper by pointing out that the aim of all anæsthetists should be to give satisfaction to the operator, and safety and a minimum of discomfort to the patient. For several years he had endeavoured to satisfy these requirements by the above-mentioned combinations. Preliminary medication is absolutely necessary:—

For children, $\frac{1}{200}$ grain atropine.

For older children (14 years upwards), $\frac{1}{4}$ grain morphine.
$\frac{1}{150}$ grain atropine.

For adults, "Hyoscine Compound A." (Burroughs Wellcome).

For strong men, "Hyoscine Compound B." (Burroughs Wellcome).

The injections are given 30 minutes before operation.

As regards the contents of the anæsthetic bottle, he recommends ethanesal alone for children and prefers it to ordinary ether. For young adults and older people equal parts of ethanesal and chloroform. Chloroform alone is only used when the cautery or diathermy is being used in the mouth. The amount of ethanesal or mixture used even in a long case is extremely small (1-2 drachms), so that the toxic action of the anæsthetic is reduced to a minimum. As regards actual administration the bag is filled three parts full of nitrous oxide and oxygen (10-1), and re-breathing starts from the beginning. In a short time the breathing becomes deep, regular and automatic. As soon as this occurs the gases are passed over the surface of the liquid in the anæsthetic bottle. After a few moments the breathing will become snoring and if the operation is on the abdomen, nose or throat the gases should be passed through the mixture so as to pick up a larger dose. The patient is then ready, and after the initial incision gas and oxygen alone are administered. The patient must be kept a pink colour, and if the anæsthesia is too light the other tap must be turned on for a minute or two. Eye signs are not of great value. The only important one is wide dilatation of the pupil. If this occurs remove bag, rapidly empty it, refill with oxygen alone, and apply to the face. After a few breaths resume anæsthesia as before. When anæsthesia has been established, the proportion of nitrous oxide to oxygen is 4 : 1. The air passages must be kept open and an artificial air-way is of great value. The patients rapidly regain consciousness and as a rule are not inconvenienced by nausea and vomiting, and the atmosphere of the theatre does not become impregnated with anæsthetic. Difficulties only occur in abdominal, nose, and throat operations. For some time many anæsthetists have been trying to get a really good relaxant for abdominal work. Gwathmey uses a combination of ethyl-chloride, ether, and chloroform; whilst McKesson recommends a saturation of nitrous oxide. The use of the combination in abdominal work requires intelligent anticipation on the part of the anæsthetist. In his experience abdominal cases were better both during and after operation with this combination than with any other anæsthetic.

As regards nose and throat work, Gwathmey had tried nitrous-oxide and oxygen, but his efforts were interrupted by the war, when he came over to Europe. Dr. Boyle, himself, met with many failures in his early cases, but finally evolved a very satisfactory technique, which is as follows :—

Preliminary medication—as before.

Injections given half an hour before operation.

The anæsthesia is induced as before, and then maintained with a tube in the mouth. An extremely small quantity of the mixture is required and the anæsthesia is chiefly conducted with nitrous-oxide and oxygen. Chloroform alone is used as the adjuvant when dia-

thermy is resorted to. In a large number of cases tubes are passed through the nostrils and the anæsthetic delivered into the endo-pharyngeal space. It is essential to get the patient well under before the operation begins. In nasal operations an artificial air-way is used and that devised by Mr. Clausen (a resident at St. Bartholomew's) is recommended. The results have been most encouraging, and Dr. Boyle hopes to develop the method further.

Endo-tracheal administration of the mixture is a recent development but the technique is not yet fully elaborated. S. R. WILSON.

La Presse Médicale, 23rd June, 1923.

The avoidance of post-operative shock. MISRACHI.

The author maintains that the preparation and the post-operation care of patients are as important factors in the production of successful results as is the skill with which the surgeon operates.

Among the many causes of shock a definite place must be given to prolonged anæsthesia; and disaster may often be averted by a combination of manual dexterity with light anæsthesia.

The suggestion is made that before major operations there is need for more careful systematic investigation as to the condition of the cardiac, renal, pulmonary, and hepatic functions; also that the blood, urea and the arterial tension are too often neglected; yet a low blood pressure may in itself be an indication for deferring operation.

As regards dieting it is pointed out that there is a tendency to starve patients too much, and that fasting may not only enfeeble the patient but actually produce acidosis.

It is difficult also to understand why the administration of saline is so often omitted from the preparations for a prolonged and bloody operation.

It is claimed that the use of oxygen inhalation, given slowly and for a prolonged period, may obviate collapse following severe operations with excessive anæsthesia; but the use of oxygen is deprecated in instances where re-breathing and CO_2 conservation are necessary.

La Presse Médicale, 4th July, 1923.

Spinal anæsthesia: inefficacy of, and mishaps with, intra-thecal injection of caffeine. P. GUIBAL.

Certain accidents, one of which was fatal, already published by M. Guibal in a series of nearly 3,500 cases of spinal anæsthesia have damped this writer's enthusiasm for this method of anæsthesia; his recent group of 420 cases contains three instances of prolonged apnœa, two of cardiac collapse, and one of death. The fatality occurred in a man aged 67 of vigorous habit, the subject of an inguinal hernia which had been strangulated for 24 hours: 10 cgr. of novocain spinally, and 50 cgr. of caffeine subcutaneously were given, and

during operation the patient became stuperous, with pale face and shallow respirations; by the end of the operation his condition had improved, he talked, raised his head, and moved his arms to help with the dressings. There then occurred a bloody evacuation, and signs of collapse, whereupon artificial respiration was practised for 1½ hours, but death supervened. Intrathecal caffeine was not resorted to because the surgeon was afraid to abandon artificial respiration even for the few seconds necessary for the injection to be given.

This objection to the use of caffeine as a curative measure being no argument against its employment as a preventative, M. Guibal adopted it as a routine together with spinal novocain in 15 consecutive cases, but the method was abandoned as inefficacious and dangerous. Its inefficacy was shown by the fact that 15 cases with caffeine produced as many instances (7) of bulbar complications as 700 cases in which novocain was used without caffeine. It seemed dangerous insomuch as quite unexpected troubles cropped up, such as paresis, anæsthesias, bedsores, etc.

Many cases are related in detail to illustrate the difficulties and dangers referred to, and M. Guibal describes the theoretical grounds upon which he bases his objection to caffeine in this connection.

La Presse Médicale, 7th July, 1923.

Two new anæsthetics. L. CHEINISSE.

Experimental research has shown that *acetylene* and *ethylene* can each be used for the production of general anæsthesia. Paul Bert showed that plus pressure was necessary in order to render N_2C and C_2 anæsthesia efficient, and Wieland explains this as due to the fact that under ordinary conditions the volume of oxygen negatives the action of nitrous oxide: experiments on animals prove that the processes influenced by N_2C are those which depend on an oxygen supply, and herein lies an essential difference between gas and the anæsthetics "proper," such as chloroform and ether, which paralyse living cells whether aerobic or anaerobic. Considering that its solubility in water was an important factor in the action of nitrous oxide, Wieland was led to try acetylene which is even more soluble, and he found the resulting anæsthesia analogous to that of N_2C, with this difference, that acetylene acted more energetically even in more dilute concentrations, the proportion varying between 3 of acetylene with 2 of oxygen, and 2 of acetylene with 3 of oxygen.

Gauss and Wieland have employed this method in 220 cases, and claim that it is free from any harmful effect upon the circulatory or respiratory systems. The duration of their operations varied from three minutes to two hours and sixteen minutes.

Ethylene was used in experiments on animals by Luckhardt and Carter in America and Canada. They found that its action was more

rapid than that of N_2C, that blood pressure was not affected, and that a good degree of muscular relaxation was obtained. At the Presbyterian Hospital in Chicago 106 patients were operated on under this anæsthetic and everybody concerned was favourably impressed.

La Presse Médicale, 11th July, 1923.

Anæsthesia of the abdominal plexuses by one injection of a solution of scurocaine. MARC ROUSSIEL.

In a man aged 66, the subject of intestinal obstruction with fæcal vomiting and extreme exhaustion, the following method gave good results :—The abdominal wall having been anæsthetised by local and regional methods, the abdomen was opened without pain but immediately the small intestines were extruded very severe colic occurred. An injection of 45 ccm. of ½ per cent. solution of scurocaine was made in the neighbourhood of the superior mesenteric artery at the root of the mesentery; in four or five minutes anæsthesia of the small and large intestines was complete and remained so throughout the operation.

It is claimed that by this method of injection an anæsthesia is obtained which involves the superior and inferior mesenteric, the lumbo-aortic, the renal, and the solar plexuses.

Gazette des Hopitaux, 8th Sept., 1923

Methods of anæsthesia in gynæcology and obstetrics. M. O. RAPIN and M. SCHICKELE.

The ideal to be sought for is a method of relieving pain during confinement without inflicting injury upon either the mother or the child; when carefully employed anæsthetics are able to relieve the mother of distress and shock which are factors in making some women dread future confinements, and in this respect anæsthetics may be regarded as a means of preventing one of the many causes of failing population.

Spinal anæsthesia, lasting only one or two hours, necessitates re-injection, a dangerous procedure, and has therefore been given up in normal labour; twilight sleep is risky on account of its tendency to produce cyanosis in the child, or to cause so intense an intoxication in the mother as to unduly prolong the course of labour. The author advocates chloral during the first stage of labour, and ethyl chloride during the second stage; he finds N_2C unsuitable except in the hands of very expert administrators owing to the narrow margin which it provides between asphyxia on the one hand, and consciousness on the other.

In gynæcology general anæsthesia will probably continue in favour, preference being given to ether, or where this is contra-

indicated, to chloroform; kelene being suitable only for short operations; and nitrous oxide failing to provide sufficient muscular relaxation.

Infiltration anæsthesia, alone or in conjunction with kelene narcosis, is safe and suitable especially for plastic operations upon the perineum, and deserves a wider popularity. Spinal anæsthesia has gained much ground but has certain drawbacks, such as persistent headache and meningeal and ocular complications, instances of death are nearly as frequent with this as with other methods, and it sometimes fails from the anæsthetic point of view. A. L. FLEMMING.

American Journal of Obstetrics and Gynæcology (508 N. Grand Boulevard, St. Louis, U.S.A.), Aug., 1923.

Resuscitation in abdominal surgery. W. WAYNE BABCOCK.

Dr. Babcock, citing drills adopted for emergency use in schools, on shipboard, etc., suggests the same drills to be prepared for emergency use in the operating theatre in case of collapse of the patient. He states that deaths are occasionally caused by the unpreparedness of the staff to proceed promptly and intelligently with proper methods of resuscitation. In his scheme the operator, his assistants, and the nurses all have their specified duties in the work of resuscitation, and if these drills are conducted regularly there is little confusion when the time comes to act seriously.

In the actual emergency treatment is directed towards the re-establishment of the circulation within *seven minutes;* the continuance of the tidal air movements in the lungs; and the maintenance of the patient's temperature. After seven minutes molecular changes in the cerebral cortex make death absolute.

The first procedure after establishing a clear airway is the intravenous injection, into a convenient vein in front of the left elbow, of 200 mils of warm physiologic saline or Ringer's solution, to which 10 minims of a 1:1000 solution of adrenalin has been added. With the first evidence of a return of pulsations of the heart, stop the injection by compressing the tube to prevent over-stimulation, since as little as half a minim of adrenalin may be ample and 10 minims might violently strain the heart. If the pulse again fails continue the injection. If the heart does not respond the injection is rapidly continued with successive additions of 15, 20, 30, or more minims of the adrenalin solution. There should be no hesitancy in the emergency to make a free incision through the skin, pick up the vein upon the finger and accurately introduce the needle into the lumen of the vein by sight.

Artificial respiration is next tried—sixteen respirations to the minute—or this failing, a piece of gauze is placed over the patient's mouth, his nostrils are compressed, and the anæsthetist quickly filling his own lungs to the utmost, mouth to mouth insufflation is

produced. By pressure over the upper abdomen the air is prevented from distending the stomach.

Further measures are cardiac massage, and, lastly, three to sixty minims of strong adrenalin solution may be injected by a fine long needle directly into the cavity of the left ventricle. The internal mammary artery lying 12 mm. lateral to the sternum must be avoided.

In Dr. Babcock's clinic he has constantly available a small emergency tray, and the senior operating-room nurse instructs the junior nurses as they report for duty to prepare and have same in readiness. If the knife, needles, and other metal parts are made of non-corrosive material they may be sterilized and re-sterilized without deterioration. A flask of saline solution, kept during operation at body temperature, with the little tray, is all the apparatus required.

Archives of Surgery (335 N. Dearborn Street, Chicago, Ill.), Sept., 1923.

De-etherization by means of carbon dioxide inhalations, with some observations on pulmonary ventilation and ether tension during anæsthesia. JAMES C. WHITE.

This paper is the report of the research undertaken to verify the suggestion made two years ago by Prof. Henderson and H. W. Haggard, that carbon dioxide, administered to ether patients, would do away with certain bad after effects, and which was based upon the physiologic principles (1) that ether, being a volatile substance carried by the blood, will be eliminated chiefly through the lungs; (2) that the rate of its elimination must, therefore, vary directly with the volume of pulmonary ventilation. Since carbon dioxide is a natural stimulus to the respiratory centre they thought its addition in small quantities to the inspired air would accomplish this purpose.

White studied forty cases, as a result of which he came to the following conclusions: By the use of carbon dioxide the volume of respiration can be raised to any desired level; recovery of consciousness is from three to five times more rapid; blood pressure, circulation and colour are materially improved; nausea, vomiting and other subjective disagreeable sensations following ether anæsthesia are reduced.

To make these tests the Henderson carbon dioxide apparatus was used, the cases covering a variety from skin graft to cerebellar tumour. In the first series carbon dioxide was started as soon as the wound was closed, respiration never failing to show an increase within the first minute, and at the end of two or three minutes it could be kept at any volume desired.

In the thirty-five cases in which carbon dioxide was administered uninterruptedly the patients recovered consciousness sufficiently to open their eyes and answer to their names in fourteen minutes; carbon dioxide being discontinued they relapsed again. If it was

continued five or ten minutes beyond this time the patients remained wide awake and were fully conscious on return to the ward. In forty control cases, untreated in this way, the average time taken to recover consciousness was one hour and fifteen minutes.

The American Journal of Surgery (Quarterly Anæsthetic Supplement), July, 1923, 15, E. 26th St., New York City.
The value of ether and controlled re-breathing in ether anæsthesia.

The author states a case for the more extended use of the closed-ether method, with re-breathing, and suggests that putting the *ether under regulated pressure* enhances its anæsthetic value.

In pointing out the good and bad features of the open and closed methods he suggests the possibility of obtaining the good of both by arranging "the working mechanical principles so as to utilize the salient good points of each and eliminate the objectionable features of both." This appliance should flexibly control the re-breathing bag and ether vapour so that accumulated dosage during re-breathing cannot take place.

Working from the hypothesis that of the 20 per cent. of oxygen inhaled from the air only 2 per cent., or one-tenth, can be demonstrated to exist in the tissues and blood stream, but that this percentage can be increased under pressure, he asks, what would be the results if we placed ether vapour under tension? Would it not be a happy situation if by pressure we could force into the blood stream the required amount of gaseous ether by using only one-tenth of the dosage ordinarily required *without* pressure?

He gives a series of 770 cases in which this method was used, the ages of the patients ranging from 20 to 94 years. He utters a word of warning, however, that "pressure and re-breathing" is not free from dangers, but these may be prevented by careful and skilful administration.

Gaceta Medica de Caracas (Caracas, Venezuela), Jan. 15, 1923.
Intraspinal anæsthesia. L. RAZETTI.

In this article Razetti gives replies received from eleven different American surgeons to a request for comment upon reprints of his Study of Intraspinal Anæsthesia. Meeker of the Mayo Clinic reports one death in 400 cases, while A. J. Ochsner had only one mishap in several years. W. W. Keen and the others think the method somewhat dangerous. Elliott Cutler notifies one death from the drug invading the medulla, and gives it as his opinion that all cases having spinal anæsthesia run this risk. Daniel F. Jones uses it in cases of diabetes, senile gangrene, operations upon the rectum in very debilitated persons, and in the second part of the two-stage operation for rectal cancer. The fall in blood pressure was alarming in a large number of cases.

Beiträge zur klinischen Chirurgie (Tübingen), 1923.

Resuscitation of the heart. HARTTUNG.

Harttung records 76 cases of *massage of the heart* with resuscitation in 35 and permanent recovery in 20. Massage only from below the diaphragm proved effectual, though dangerous, in one case necropsy showing a valve laceration. Brain functioning ceases in ten minutes, after which the procedure is useless. Intracardiac injection is preferable as being less dangerous, his method being to inject 1 cc. of the one per thousand solution of epinephrin into the right ventricle through the fourth interspace, close to the sternum.

Deutsche Zeitschrift für Chirurgie (Leipzig), March 20, 1923.

Blocking the splanchnic nerves. E. METGE.

Metge applied Kappis' technique in 104 cases, having given scopolamin and morphin beforehand. The blood pressure in 78 cases dropped to under one-half without doing any special harm. He reports three deaths from pneumonia in 112 operations under splanchnic nerve blocking, but he had seven pneumonia fatalities under other anæsthetics in the same number of operations which were performed simultaneously.

Sei-I-Kwai Medical Journal, Tokio, June, 1923.

Effect of chloroform narcosis on growth of transplanted animal tumours. KYMURA.

Kymura and two colleagues found, in a series of experiments upon animals under anæsthesia or during operation, chloroform had no marked stimulating effect on the growth of inoculated tumours.

Klinische Wochenschrift, Berlin, May 7, 1923.

Lundwall and Mahnert report a series of twelve cases of *severe and persistent headache after intraspinal anæsthesia.* They injected 40 cc. of a 40 per cent. solution of hexamethylenamin into the ulnar vein with prompt relief.

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